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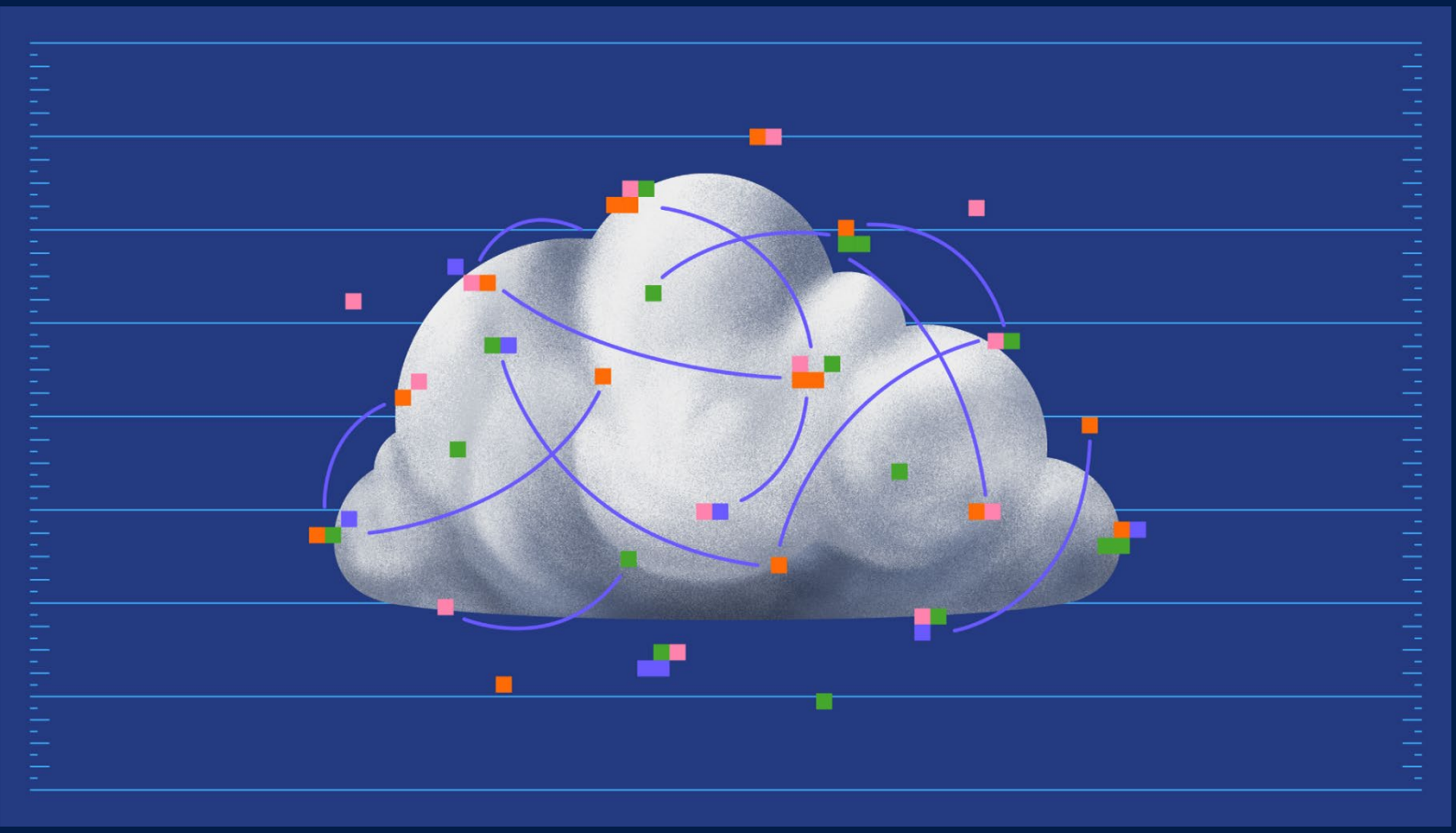

Sizing the Inevitable Investment Opportunity: Climate Adaptation

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Executive summary

Climate adaptation is an inevitable need and investment opportunity. Research on climate-related investment opportunities has largely focused on decarbonisation, reflecting the urgent need to transition to a lower-carbon global economy. In contrast, climate adaptation has received comparatively less attention, partly due to the misperception that it is primarily the responsibility of national governments. Yet as the physical impacts of climate change escalate, adaptation will need to scale across all levels of society, from governments and businesses to communities and households. This creates a vital role for the private sector in strengthening economic and community resilience to physical climate risks. Companies offering adaptation solutions are thus emerging as a complementary and increasingly investible part of the broader climate response.

In partnership with Bain & Company, we reviewed industry and scientific studies to identify the climate adaptation solutions most relevant to private sector investors. Our research was augmented by interviews with experts across a range of fields, including industry practitioners, climate scientists, insurers, and weather modellers, for a more holistic assessment of the size and nature of the opportunity.

We examined a broad investment universe before narrowing our focus on a select group of adaptation solution categories. Within this set, we identified emerging and more established solutions to develop early-stage estimates of the potential investment opportunity, both current and future. We sized their total addressable market (TAM), quantified their potential investment value, and evaluated the proportion of market revenue driven by climate change.

Our study revealed five key findings:

- **Global annual revenues** from a select set of climate adaptation solutions are projected to grow from **US$1 trillion (tn) today to US$4tn by 2050** in our

Base Case.[1] Of this, we estimate US$2tn will be incremental revenue growth driven by global warming—a factor not typically accounted for in current industry forecasts.

- The corresponding **investment opportunity set** across public and private debt and equity is expected to increase from **US$2tn today to US$9tn by 2050**, with US$3tn representing an incremental increase attributable to global warming. While our model conservatively assumes adaptation demand will be reactionary, greater awareness of physical risks may prompt a shift to anticipatory action, accelerating revenue growth and related investment opportunities before 2050.
- **The opportunity remains significant regardless of climate scenario.** Variation in estimated value is +/-4% across scenario bookend,[2] as projected temperature differences over the next 25 years are minimal across scenarios.[3] This suggests investors can build conviction in this space without needing to predict the precise climate pathway.
- **In our Base Case, we expect adaptation revenues in 2050 to exceed projections based on historical trends by 61%.** This upside surprise reflects the difficulty of translating climate science into long-term business implications. Most financial planning and analysis (FP&A) teams and sell-side analysts continue to rely on historical data for forecasting. This information gap presents long-term investors with a unique opportunity to invest in a space where company earnings may positively surprise as demand for adaptation solutions increases.
- **The inevitable need for climate adaptation will fuel growth across both established and emerging solutions.** Our analysis suggests that

[1] Our Base Case is the United Nations Intergovernmental Panel for Climate Change's (UN IPCC) SSP2-4.5 scenario from the Sixth Assessment Report (AR6), which is approximately a 2.7ºC scenario, a temperature outcome estimated by the Climate Action Tracker based on current policies and actions.
[2] The bookend climate scenarios referred to here are the UN IPCC's AR6 SSP1-1.9 scenario (or what most would refer to as a net zero by 2050 scenario that achieves below 1.5ºC) and the SSP5-8.5 scenario (or what most refer to as a failed transition that exceeds 4ºC).
[3] The severity of the physical impacts of global warming diverge greatly only after 2050.

climate adaptation will foster technological innovation (e.g. weather intelligence) while boosting the adoption of mature technologies (e.g. weather-resilient building materials). Together, these dynamics create investment opportunities across traditional and emerging industries.

While decarbonisation remains essential to mitigating emissions, our research highlights climate adaptation as a complementary investment theme—one that is gaining importance as the physical impacts of climate change become more pronounced. Both offer valuable opportunities for long-term investors, addressing different but urgent dimensions of the climate challenge.

Introduction

Global warming is accelerating. Temperatures in 2024 reached record highs in our 175-year observational record, averaging 1.5ºC above the pre-industrial average from 1850-1900.[4] The frequency and severity of extreme weather events are increasing, having caused US$4tn in reported economic losses over the last five decades.[5]

Governments, businesses, and households will need to find ways to survive and thrive in a world characterised by rising physical climate risks, driving greater demand for climate adaptation solutions.

Research on investment opportunities related to climate change has typically focused on decarbonisation. Few studies have examined climate adaptation solutions from a private sector investor's perspective, partly because of the misperception that adaptation is mainly a government responsibility. In contrast, we believe that companies offering these solutions present promising investment

[4] European Commission Copernicus Programme (2025). *Copernicus: 2024 is the first year to exceed 1.5ºC above pre-industrial level*
[5] World Meteorological Organization (2023). *Atlas of Mortality and Economic Losses from Weather, Climate and Water-related Hazards (1970-2021)*.

opportunities, enabling investors to contribute to building economic and community resilience.

In partnership with Bain & Company, we reviewed industry and scientific studies to better understand the investment opportunities in climate adaptation solutions. Additionally, we interviewed experts across a range of fields, including industry practitioners, climate scientists, insurers, and weather modelers. This enabled us to assess climate adaptation opportunities more holistically, drawing on insights from multiple industries and disciplines.

We examined 21 discrete climate adaptation solutions, sized their TAM, and quantified their investment value. Additionally, we introduced the concept of "Climate Elasticity of Demand" to evaluate the proportion of market revenue driven by climate change—a factor not fully accounted for by industry experts.

This paper is divided into three parts:

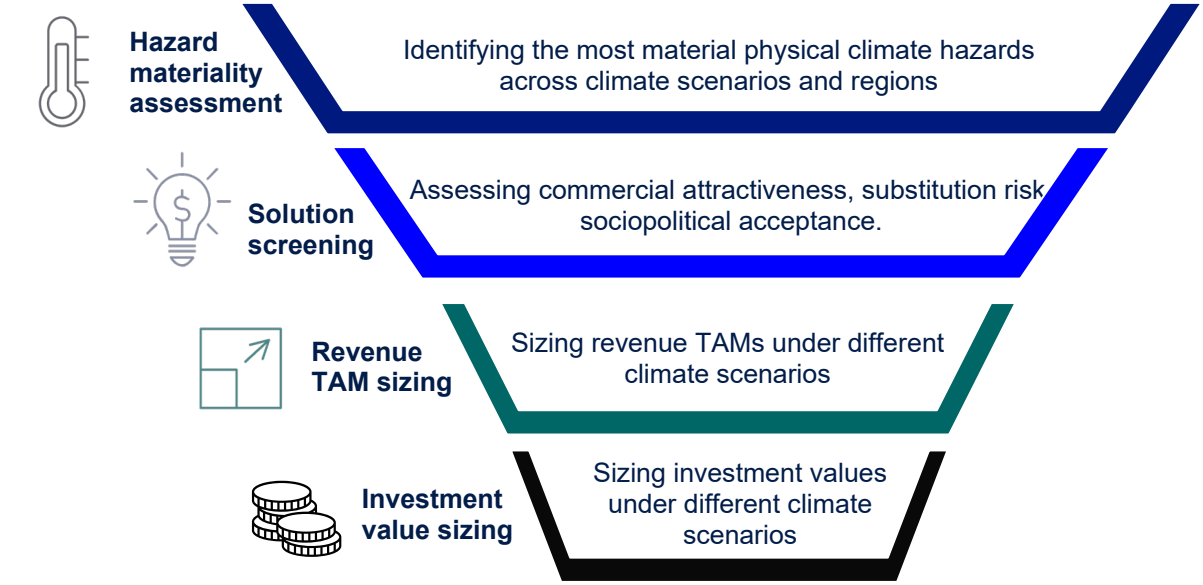
i) Methodology
ii) Key findings
iii) Select climate adaptation solution examples

Section I: Methodology

The universe of climate adaptation solutions is vast, with the Climate Bonds Initiative identifying over 1,400 solutions in its pioneering Climate Bonds Resilience Taxonomy (CBRT). [6] Unlike decarbonisation, definitions of climate adaptation solutions are still evolving. Many solutions serve dual purposes, addressing both emissions mitigation and climate adaptation.

To navigate this complexity and focus our research, we developed a methodology to curate the most critical climate adaptation solutions, size their revenue TAMs, and quantify the value of selected investment opportunities (Figure 1).

Figure 1: Steps to size the demand for critical adaptation solutions



1. **Hazard materiality assessment:** We analysed past economic impacts [7] and projected increases in the frequency and intensity of climate events[8] to identify the most economically material chronic and acute climate hazards by region. This led us to prioritise five hazard

[6] Climate Bonds Resilience Programme.
[7] Historical analysis is based on cumulative global economic losses caused by climate events based on data from EM-DAT.
[8] Forward-looking assessments use a combination of assessments from the IPCC and discussion with industry experts, such as climate modellers, insurers, etc.

categories—storm, flood, wildfire, heat stress, and water stress—which are expected to drive substantial future adaptation spending across major economies, including both developed and emerging markets.

2. **Solution screening:** Using the CBRT as a starting framework, we initially identified over 1,400 adaptation solutions. We then applied additional criteria to ensure minimal maladaptation risks,[9] minimal harm to other global sustainability objectives, and relevance to the key climate hazards identified. This led to a refined list of ~600 solutions. Further curation focused on selecting tangible adaptation products and services, rather than adaptation measures driven by societal or behavioural changes and policy interventions. This resulted in ~50 potential solution categories. Solutions with significant overlap with climate mitigation (primarily nature-based solutions) were omitted to focus on "pure-play" adaptation solutions as much as possible, which were then assessed for relative investment attractiveness[10]. This narrowed the list down to 14 climate adaptation solution categories, which were further granularised into 21 discrete products and services. (See Appendix, Figure 7, for more details.)

3. **Revenue TAM sizing:** Revenue TAMs for solutions identified above were modelled for the 2024-2050 period across four climate scenarios (Figure 2).

[9] Maladaptation refers to actions or strategies intended to enhance resilience to climate change that inadvertently increase vulnerability or exacerbate existing problems.
[10] We assessed investment attractiveness across five key dimensions: presence of clear buyers, scalability and growth potential, climate elasticity of demand, substitution risk and sociopolitical acceptance.

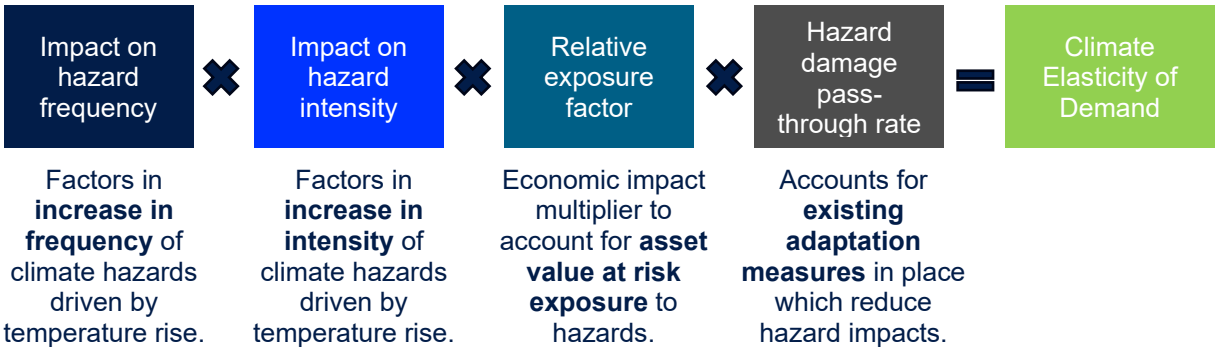
Figure 2: Climate scenarios[11]

Scenarios	Description
"Stable Temperature" **Reference Scenario**	• Models projected demand for climate adaptation solutions assuming no further global warming beyond current conditions.
The below three scenarios incorporate demand from the Reference Scenario and additional demand created due to climate change.	
Base Case	• Reflects global warming outcomes based on current climate policies, with warming projected to reach **2.7°C** by end of century. Aligns with IPCC's SSP2-4.5 scenario.
Low Case	• Assumes a 2050 net-zero pathway, leading to **1.4°C** warming by the end of century. Aligns with IPCC's SSP1-1.9 scenario.
High Case	• Reflects failure in global transition towards green economy, leading to a **>4°C** warming outcome. Aligns with IPCC's SSP5-8.5 scenario.

Modelling the additional revenue demand driven by rising temperatures comes with challenges, as it requires an interdisciplinary approach of blending scientific evidence with traditional industry knowledge. While our Reference Scenario incorporates the latter, we introduced a new modelling element to forecast demand for our three climate change scenarios (Base Case, Low Case, and High Case) through the novel concept of **"Climate Elasticity of Demand"**. This measures how global warming affects the demand for goods and services, taking into account four key components explained in Figure 3. For a detailed example of how Climate Elasticity of Demand is calculated, please refer to Figure 8 in our Appendix, which illustrates the methodology for a theoretical hazard labeled '*Climate Hazard X*.'

[11] Our Base Case scenario aligns with GIC's 'Too Little Too Late' scenario, while the Low Case corresponds to GIC's 'Net Zero' scenario, and the High Case reflects GIC's 'Failed Transition' scenario. More details on GIC's climate scenarios can be found in The GIC Climate Signposts: An Investor Tool for Navigating an Uncertain Future (2023).

Figure 3: Components of our Climate Elasticity of Demand



Source: GIC Sustainability Office, Bain & Company

4. **Investment value sizing:** We leveraged a comprehensive and granular company fundamentals database,[12] and information from company annual reports, websites, and investor presentations. By distilling this data with a combination of large language model (LLM) and human analysis, we built comparable baskets of listed companies with substantial revenue exposure to the 21 discrete climate adaptation solutions. For each basket, we analysed historical valuation multiples at the solution level to translate future revenue TAM estimates into estimated investment value.[13]

[12] This database included ~49,000 entities, their business descriptions, revenue segmentation by products and valuation multiples.
[13] Investment value refers to enterprise value (including both debt and equity).

Section II: Key findings

In our Base Case, the **revenue TAM for our curated set of climate adaptation solutions is projected to grow from approximately US$1tn today to US$4tn by 2050**. Of this, we estimate US$2tn will be incremental revenue growth driven by global warming—a factor not widely incorporated into current industry forecasts.

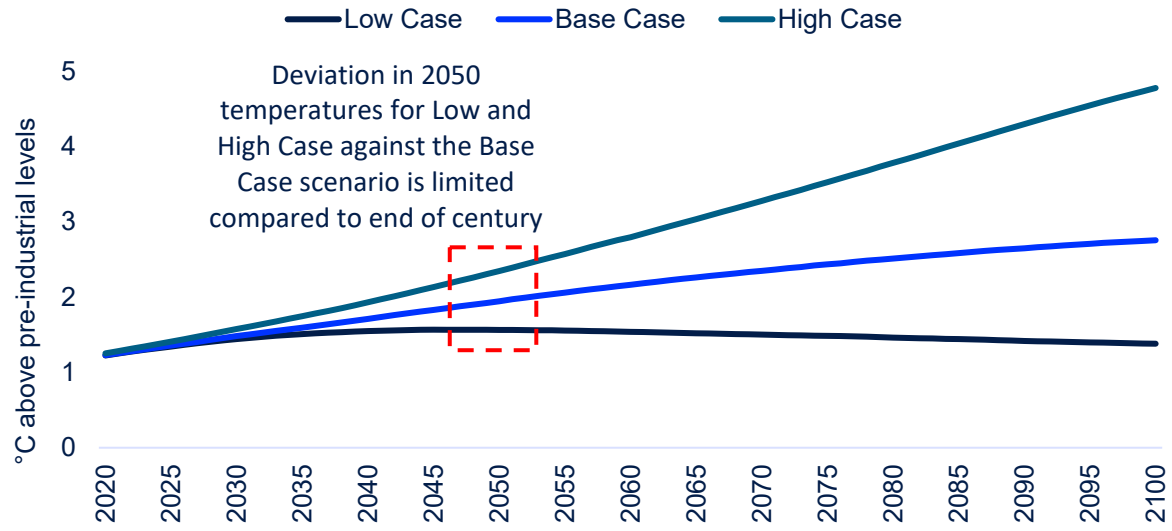
On average, **revenue growth is expected to accelerate most significantly from 2040 onwards** as physical climate risks intensify, although the timing of this acceleration varies by climate adaptation solution. For example, fire-resistant and wind-resistant building components may experience earlier accelerated growth due to the already high severity of underlying climate hazards *and* currently low adoption rate of these solutions.

The corresponding **value of the investment opportunity**, in enterprise value terms, **is estimated to increase from US$2tn today to US$9tn by 2050**, with US$3tn attributed to incremental growth driven by global warming.

As compared to the Base Case, the Low Case and High Case climate scenarios show a **variation of +/-4% in the estimated value of the investment opportunity by 2050**.

This small variation arises because the anticipated differences in global warming across scenarios are minimal over the next 25 years, with the most divergence between scenarios expected to materialise in the second half of the century (Figure 4). This means **investors can build conviction in climate adaptation without needing to predict the precise climate scenario** that will unfold between now and 2050.

Figure 4: Global warming pathways in climate change scenarios

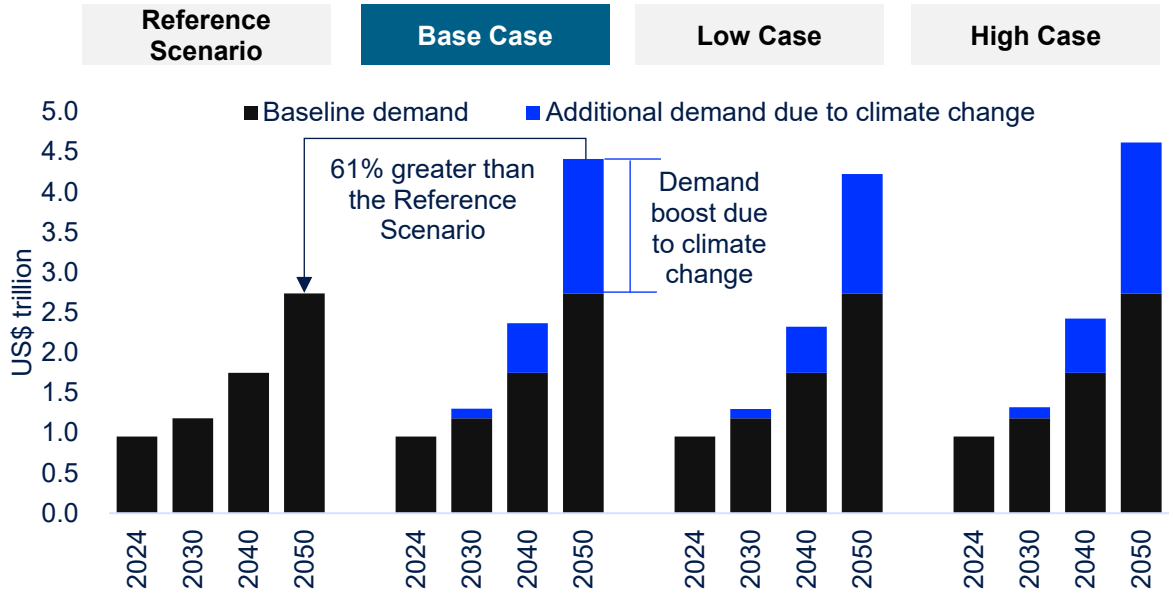


Source: GIC Sustainability Office analysis, Bain & Company, IPCC

In our Base Case, we expect 2050 revenues to exceed forecasts based on historical trends by 61% (Figure 5). This upside surprise stems from the challenge of translating climate science into long-term business implications. Most financial planning & analysis (FPA) teams and sell-side analysts continue to rely on historical data for forecasting. This information gap creates a unique opportunity for long-term investors to invest in a space where company earnings may positively surprise as demand for climate adaptation solutions grows.

Although estimates in Figure 5 conservatively assume demand to be reactionary (e.g. demand will follow rising temperatures as they occur), increasing awareness of physical risks may lead to a more anticipatory response. This shift would accelerate expected growth in demand, creating stronger near-term tailwinds for solution providers well ahead of 2050.

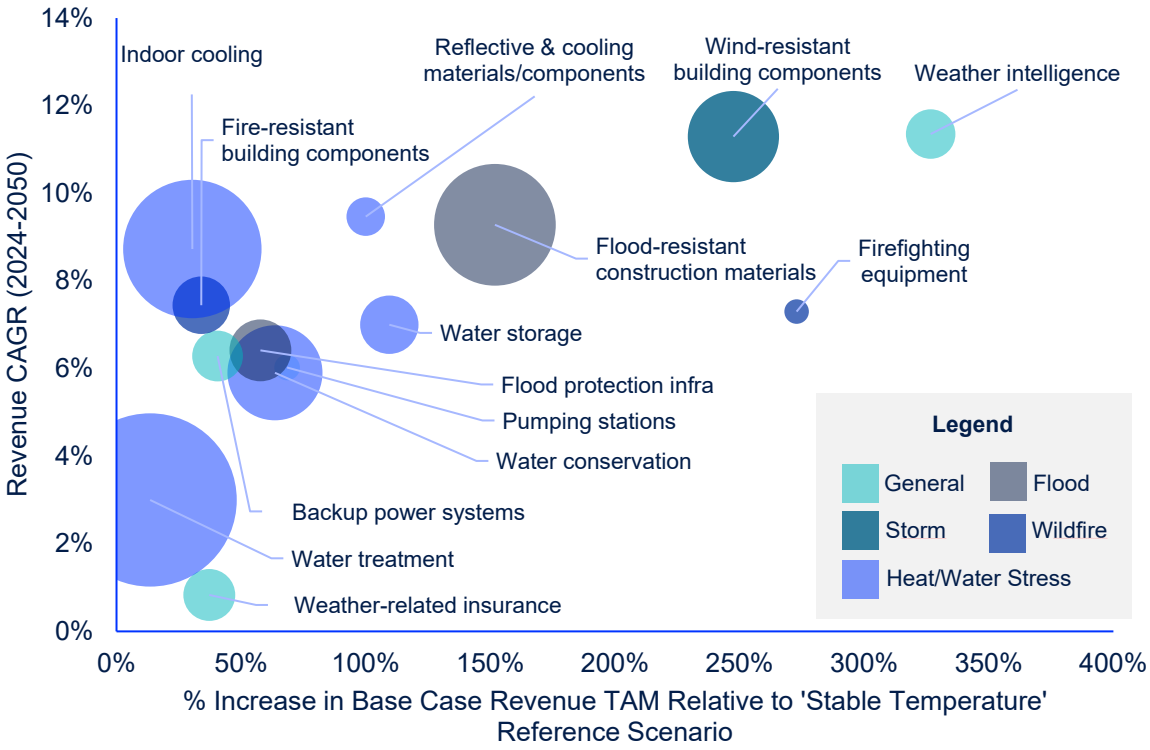
Figure 5: Revenue TAM forecasts for adaptation solutions



Source: GIC Sustainability Office analysis, Bain & Company

Continued global warming is expected to drive growth opportunities across all the adaptation solution categories we assessed. We expect this to happen through a combination of **technological innovation from emerging solutions** (e.g. weather intelligence) and **increased adoption of traditional solutions** that will become increasingly more relevant (e.g. weather resilient building materials).

Figure 6: Base Case scenario investment value and revenue growth by 2050 across adaptation solution groups



Note: Bubbles represent 2050 enterprise value. Charts are not to scale. X Axis represents the % difference between the 2050 total revenue TAMs in our Base Case relative to 2050 revenues from the 'Stable Temperature' Reference Scenario.

Source: GIC Sustainability Office analysis, Bain & Company

Section III: Select climate adaptation solution examples

Climate adaptation is set to create opportunities across both established and emerging solutions. Below, we highlight examples of emerging solutions driven by technological innovation, such as weather intelligence, and mature solutions expected to see increased adoption, such as wind-resistant building components and flood-resistant construction materials.

Weather intelligence solutions transform weather data into actionable insights for various industries and applications. For example, they can help optimise flight routes, forecast renewable energy generation, and assist agricultural businesses with irrigation and harvesting planning. Climate change and physical risks necessitate complex analysis of diverse data sources, driving demand for companies that provide intelligence and analytics solutions. Although the market is currently nascent and relatively small, we forecast annual revenues for weather intelligence to grow 16-fold to over US$40 billion (bn) by 2050, making it one of the fastest-growing segments in our analysis.

Wind-resistant building components enhance resilience against storms and hurricanes, which accounted for over 55% of global economic damages from climate-related events between 2000 and 2024.[14] Solutions include high-strength doors and windows, reinforced roofs, and structural reinforcement products that increase the structural integrity of buildings. Global adoption of these products has been relatively inconsistent due to a lack of strong and comprehensive regulations. However, we forecast demand for these products to exceed US$650bn by 2050, up from around US$40bn currently, driven by growing requirements from insurers, the introduction of more stringent building codes, and increased consumer willingness to build resilience against storms.

[14] Analysis of EM-DAT data from GIC Sustainability Office and Bain & Company.

Flood-resistant construction materials are designed to prevent flood damage and include waterproof materials, sealants, non-return valves, and permeable surfaces to reduce surface runoff. Historically, floods have accounted for approximately 30% of economic losses from climate-related events[15] and are expected to increase in both frequency and intensity in the coming decades, particularly in Europe and Asia. We forecast the market for flood-resistant materials to exceed US$680bn by 2050, driven by factors similar to those influencing demand for wind-resistant solutions. While regulations for flood-proofing have been less comprehensive and stringent than those for fire-resistant building materials, we anticipate this will change as flood events become more prevalent.

[15] Analysis of EM-DAT data from GIC Sustainability Office and Bain & Company.

Conclusion

Climate adaptation is becoming both an unavoidable necessity and a significant investment opportunity—one that investors can no longer afford to overlook. As climate-related physical risks increase, so too will demand for adaptation solutions.

Our research indicates that **the investment opportunity for a select set of climate adaptation solutions could reach US$9tn by 2050**, with US$3tn driven by rising temperatures—a value likely underestimated by industry experts due to the challenges of translating climate science into business implications. We conservatively assume demand will be reactionary, with much of the growth occurring beyond the next decade as temperatures rise. However, if demand becomes anticipatory due to growing awareness of physical risks, growth could accelerate significantly before 2050.

Investors have analysed climate scenarios extensively for decarbonisation investments. This is because climate policies and technology costs vary widely across scenarios, which have a profound impact on investments in companies providing decarbonisation solutions.[16]

For climate adaptation solution providers, however, the specific climate scenario matters less in the short to medium term. Our analysis shows that over the next 25 years, the revenue TAM of climate adaptation solutions varies only by +/-4% from the Base Case. Compared to decarbonisation, the climate adaptation theme is less exposed to volatility from climate policy developments.

To be clear, decarbonisation remains a significant investment theme that addresses the critical need to reduce greenhouse gas emissions and continues to offer valuable investment opportunities. At the same time, our research highlights climate adaptation as a substantial investment theme,

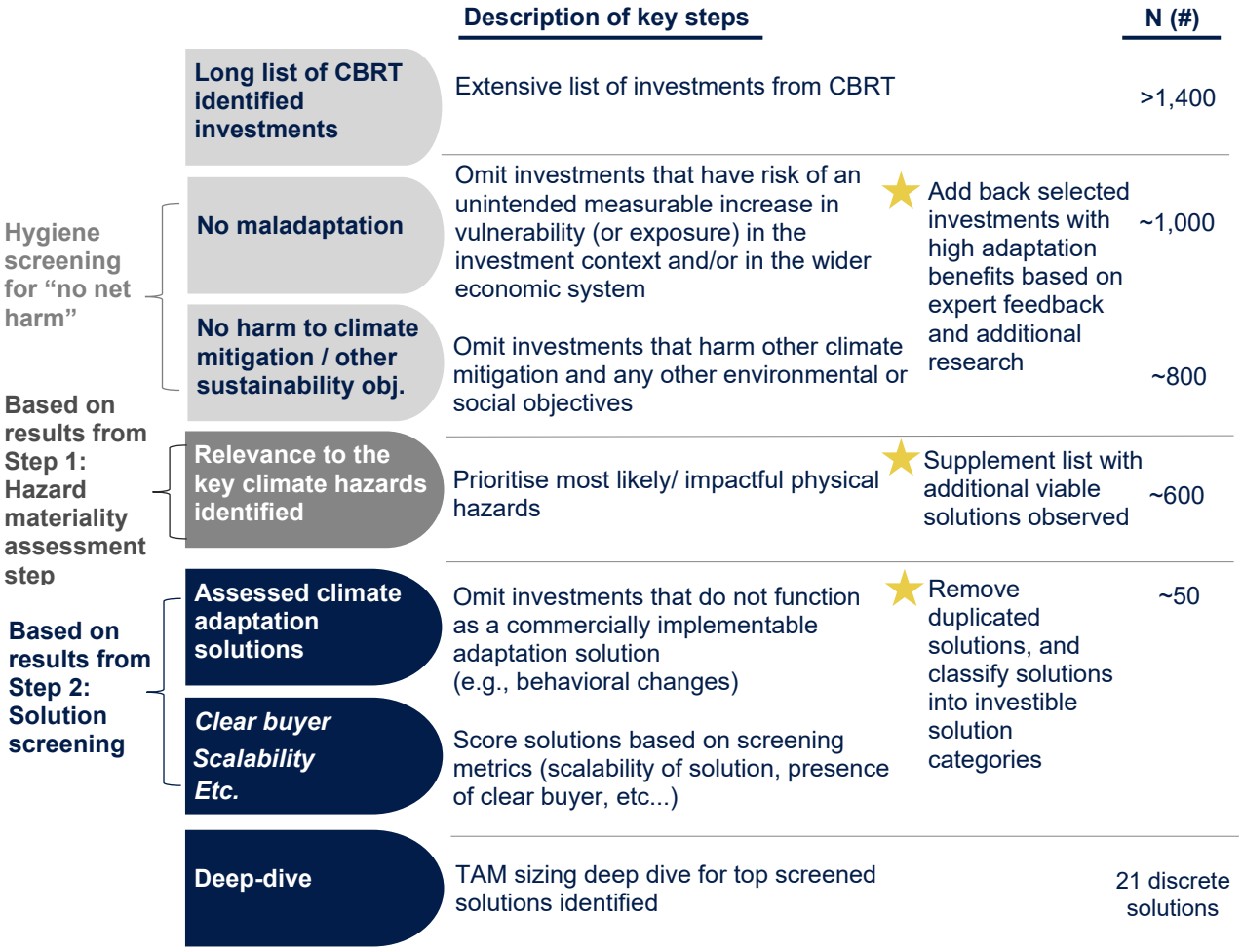
[16] GIC ThinkSpace: Beyond Financing Gaps: Sizing the Decarbonisation Investment Opportunity (2023)

warranting **a fair share of attention** from private sector investors seeking long-term, risk-adjusted returns.

Climate adaptation is a fast-changing space with scientists advancing our understanding of climate hazards, engineers improving or inventing new adaptation solutions, and standard-setters creating new investment taxonomies. This paper is not the final word on investing in this theme. Rather, our intention is to **connect climate science with industry fundamentals, provide early insights into climate adaptation solutions, and spark further discussion among investors**. As understanding of this area evolves, we welcome your feedback and perspectives on this critical investment opportunity.

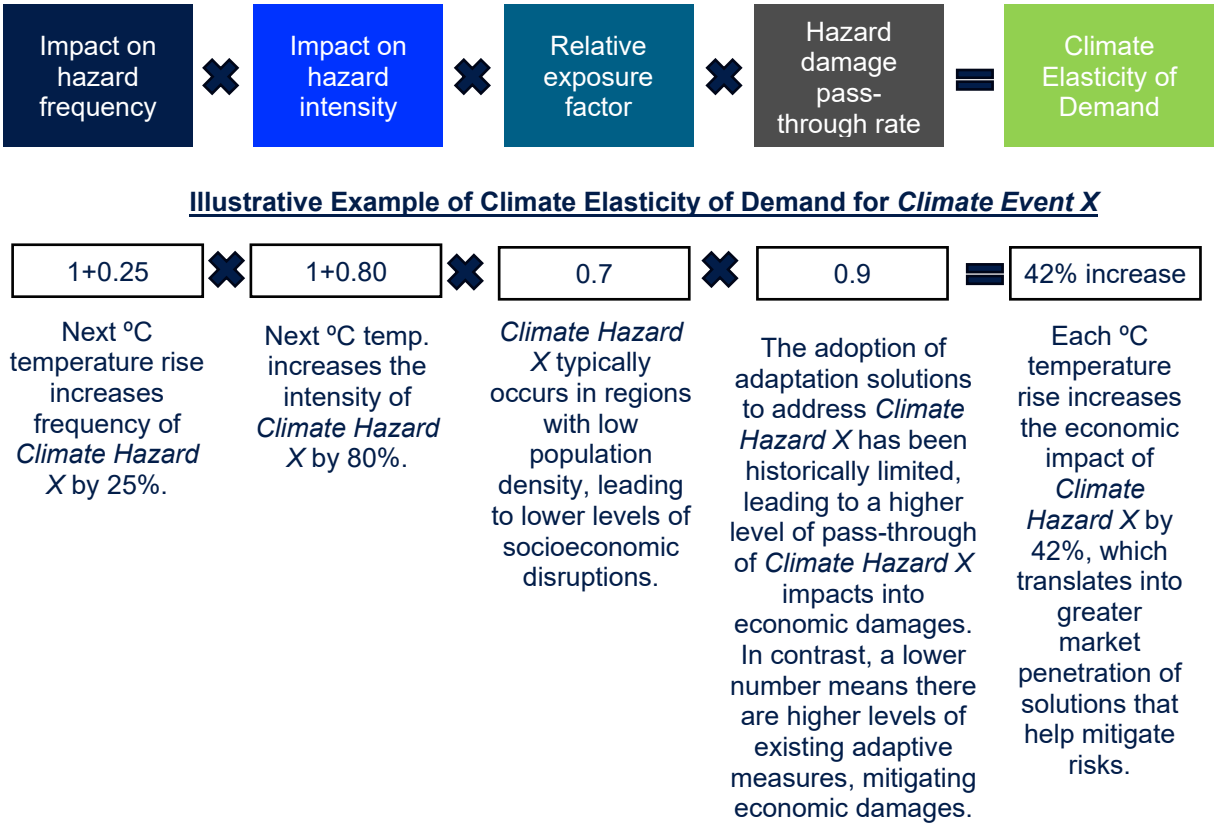
Appendix

Figure 7: Screening process to identify priority adaptation solutions



Source: GIC Sustainability Office analysis, Bain & Company, Climate Bonds Initiative Climate Bonds Resilience Programme

Figure 8: Illustrative overview of how climate elasticity of demand is calculated for a theoretical 'Climate Hazard X'



Source: GIC Sustainability Office, Bain & Company

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